LIST OF TABLES

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ABBREVIATIONS AND SYMBOLS

AERA	Aquatic Ecological Risk Assessment
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ARD	Acid Rock Drainage
AWQC	Ambient Water Quality Criteria
bgs	Below ground surface
BMP	Best Management Practices
BMSG	Blackbird Mine Site Group
BRCP	Biological Restoration and Compensation Plan
CCC	Criteria Continuous Concentration (chronic criteria)
CERCLA	Comprehensive Environmental, Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CMC	Criteria Maximum Concentration (acute criteria)
COC	Chemical of Concern
COPEC	Chemical of Potential Ecological Concern
CRP	Community Relations Plan
CSM	Conceptual Site Model
CWA	Clean Water Act
cy	Cubic Yards
DEQ	Department of Environmental Quality
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ESA	Endangered Species Act
ESD	Explanation of Significant Difference
ESV	Ecological Screening Value
FS	Feasibility Study
gpm	gallons per minute
HEAST	Health Affects Assessment Summary Table
HI	Hazard Index
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
HR	Home range
IC	Institutional Controls
IDEQ	Idaho Department of Environmental Quality
IRIS	Integrated Risk Information System

ABBREVIATIONS AND SYMBOLS (continued)

IWQS	Idaho Water Quality Standard
LOAEL	Lowest observed adverse effect level
MCL	Maximum Contaminant Level
MBTA	Migratory Bird Treaty Act
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOEC	No observed effect concentration
NOAEL	No observed adverse effect level
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
O&M	Operation and Maintenance
PCI	Panther Creek Inn
PEC	Probable effects concentration
PRP	Potentially Responsible Party
PRG	Preliminary Remediation Goal or Preliminary Removal Goal
RA	Risk Assessment
RAO	Remedial Action Objective
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROC	Receptor of Concern
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SF	Slope Factor
SRB	Sulfate-reducing bacteria
TERA	Terrestrial Ecological Risk Assessment
TEC	Threshold Effects Concentration
TEL	Threshold Effects Level
TOC	Total organic carbon
TRV	Toxicity Reference Value
UAA	Use Attainability Analysis
UCL	Upper Confidence Limit
UTL	Upper Tolerance Level
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey

ABBREVIATIONS AND SYMBOLS (continued)

WQS	Water quality standard
WTP	Wastewater Treatment Plant
XRF	X-ray fluorescence

TABLE 5-1b

ANALYTICAL RESULTS FOR PRIVATE WATER SUPPLIES SAMPLED

Parameters	Date Location Id Number Filt/Unfiltere	06/26/95 PCI Well No. 1 950245	09/18/02 PCI Well No. 1	09/18/02 PCI Well No. 2	09/22/95 GEORGE FERNANDEZ 952327 U	09/22/95 SILLINGS CABIN	09/22/95 SILLINGS HOUSE	09/22/95 WARBARTON 952324
	Units							
LAB								
Alkalinity	µg/L as		15300	47600		123000	124000	82000
Aluminum	µg/L				63.3 B	41.6 B	38.4 B	20.4 U
Arsenic	µg/L	3 BJ	2	16	77.8	1.5 U	1.5 U	22.8
Calcium	µg/L		18900	20900	23400	40300	41300	21800
Chloride	µg/L		5200	10000		2480	2470	2900
Cobalt	µg/L	244	290	208	11.5 B	4.9 U	4.9 U	4.9 U
Copper	µg/L	18.6 B	22	35	0.6 U	0.6 U	0.69 B	3.1 B
Iron	µg/L		40	3700	85.2 B	100	116	16.5 U
Magnesium	µg/L		5880	5580	3620 B	5570	5700	4760 B
Manganese	µg/L	10.7 B	3	2120	1.1 U	4.3 U	6.5 U	4.8 U
Nickel	µg/L	11.7 U			14.4 U	14.4 U	14.4 U	14.4 U
Potassium	µg/L		3900	5900	2290 B	4960 B	5010	2400 B
Silicon	µg/L				7800 J	6140 J	6400 J	4020 J
Sodium	µg/L		3400	5900	7170	5650	5740	6940
Sulfate	µg/L		62600	43600		18400	18300	11500
Total Dissolved Solids	µg/L		156000	151000		129000	142000	76000
Total Suspended	µg/L		500	3500		1400	1300	100 U
FIELD								
Conductivity	µS/cm	210	130	159		260		178
Dissolved Oxygen	mg/L	13.4	6.06	6.2		10.9		1.96
pH	Std Unit	6.17	6.87	6.53		7.64		7.85
Temperature	°C	13.5	12.7	10.4		8.1		11.6
Turbidity	NTU	2	2	5		1		

B = Analyte detected at a value between the minimum detection limit and the practical quantitation limit
J = Estimated value
U = Non-detect

Note: Blanks indicate analysis for the parameter was not performed.

TABLE 5-2

SUMMARY OF SURFACE SAMPLING FOR WASTE ROCK REMAINING AFTER EARLY ACTIONS

Location	Number of Samples	Copper				Cobalt[3]				Arsenic			
		Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)
Haynes-Stellite Area	14	21.0	324.0	130.2	122.5	20.0	3210.0	361.4	177.5	6.1	5550.0	568.9	129.5
Upper Meadow Creek Drainage - 7300 WRD and 7400 WRD	3	830.0	2450.0	1460.0	1100.0	-	-	-	-	660.0	1290.0	880.0	690.0
Meadow Creek North End - 7700 WRD[5]	4	200.0	1400.0	750.0	700.0	-	-	-	-	75.0	940.0	291.3	75.0
Meadow Creek West Side - 7800 WRD	50	200.0	20200.0	1905.8	875.0	-	-	-	-	75.0	5900.0	956.1	475.5
Bucktail Drainage - Remaining West Lobe	16	660.0	2700.0	1738.1	1850.0	-	990.0	-	-	75.0	2200.0	1251.6	1155.0
Bucktail Drainage - East Slope WRD	40	200.0	13000.0	1754.0	1300.0	-	1050.0	-	-	75.0	3200.0	843.6	730.0
7117 WRD	14	200.0	7370.0	1355.0	735.0	-	-	-	-	75.0	3160.0	484.1	147.5
7265 WRD	4	430.0	4030.0	1475.0	720.0	-	-	-	-	75.0	939.0	414.8	322.5

Notes:

1. WRD = Waste Rock Dump
2. Non-detect results were set to a value equal to half the detection limit (detection limits varied from data set to data set).
3. Aside from the Haynes-Stellite Area, most samples tested below the XRF detection limit for cobalt. A "-" indicates that all samples in the area tested below the detection limit.
4. Data compiled from Golder (1996d), Golder (1996f), Golder (1997d), and Beltman et. al. (1993)
5. Many samples had arsenic concentrations below the XRF detection limits; therefore, the median and minimum reflect one-half the detection limit.

Table 5-3

Summary of West Fork Tailings Impoundment Soil Sampling

Location	As (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	S (mg/kg)
West Fork Transect 1 (Composite of Samples 1-4)	554	640	39900	ND
West Fork Transect 2 (Composite of Samples 5-8)	389	410	34100	ND
West Fork Transect 3 (Composite of Samples 9-12)	298	171	16800	ND
West Fork Transect 4 (Composite of Samples 13-16)	273	182	24500	ND
West Fork Transect 5 (Composite of Samples 17-20)	533	650	33700	ND

Note: Four discreet samples were collected for each transect and analyzed with XRF

TABLE 5-4

SUMMARY OF LOWER BUCKTAIL DEBRIS-FLOW SAMPLING FOR DEPOSITS REMAINING AFTER EARLY ACTIONS

Location	Number of Samples	Copper				Cobalt [1]				Arsenic			
		Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)
Lower Bucktail													
Between Upper and Lower Sediment Dams	80	265.0	14690.0	3921.6	2756.5	125.0	1429.0	183.4	125.0	46.0	1205.0	650.0	807.5

Notes:

1. Most of the samples tested below the detection limit for cobalt; therefore, the minimum, mean, and median reflect this result.
2. Data from Golder (1995h) and Golder (1997c).
3. Non-detect results were set to a value equal to half the detection limit (detection limits varied from data set to data set).

TABLE 5-5

SUMMARY OF OVERBANK SAMPLING FOR DEPOSITS REMAINING ALONG BLACKBIRD AND BIG DEER CREEKS AFTER EARLY ACTIONS [1]

Location	Number of Samples	Copper Min (mg/kg)	Copper Max (mg/kg)	Copper Mean (mg/kg)	Copper Median (mg/kg)	Cobalt Min (mg/kg)	Cobalt Max (mg/kg)	Cobalt Mean (mg/kg)	Cobalt Median (mg/kg)	Arsenic Min (mg/kg)	Arsenic Max (mg/kg)	Arsenic Mean (mg/kg)	Arsenic Median (mg/kg)
Big Deer Creek													
Big Deer Creek (Table 5-35 of this RI) [2]	17	49.8	17200.0	2069.8	654.0	15.2	619.0	129.7	53.4	7.0	72.3	25.1	19.6
Big Deer Creek (Golder 1996d) [3, 4, 6, 7]	18	150.0	4500.0	1990.3	2050.0	152.5	750.0	-	750.0	75.0	268.0	128.9	75.0
South Fork of Big Deer Creek (Golder 1996d) [3, 4]	7	2100.0	42000.0	11137.5	7450.0	750.0	1600.0	856.3	750.0	75.0	820.0	558.1	605.0
Blackbird Creek (from the base of 6850 Waste Rock Dump to just north of Panther Creek Inn)													
Areas Not Included in 1999 Removal Actions (Golder 1996d, 2000e) [4]	73	116.0	41000.0	1946.9	540.0	91.0	97700.0	3054.9	750.0	50.0	#######	5504.5	2100.0
Post-Removal Sampling in Areas Included in 1999 Removal Actions (Golder 2000e) [4, 5]	87	150.0	3000.0	807.9	570.0	NT	NT	NT	NT	50.0	20270.0	1790.6	970.0
Panther Creek Inn (including PCI Campground and East Campground)													
Areas Not Included in 1999 Removal Actions (Golder 1996d, 2000e)	3	72.0	116.0	97.7	105.0	62.0	94.0	80.3	85.0	46.0	64.0	57.7	63.0
Post-Removal Sampling in Areas Included in 1999 Removal Actions (BMSG 1999) [4,6]	73	150.0	4500.0	389.2	150.0	NT	NT	NT	NT	50.0	1900.0	334.8	50.0

Notes:

1. NT = Not Tested (or not presented).
2. These samples were analyzed in a laboratory, so their detection limits are lower than for the Big Deer Creek samples in Golder (1996d)
3. These samples were analyzed using XRF, so their detection limits are much higher than for the laboratory values presented in Table 5-32 of this RI
4. Non-detect results were assigned a value equal to one-half the detection limit (detection limits varied from data set to data set).
5. These samples are post-removal samples (i.e., samples taken from areas subsequent to overbank deposit removal).
6. Many samples had arsenic concentrations below the XRF detection limits; therefore, the median and minimum reflect one-half the detection limit.
7. All of the samples analyzed for cobalt by XRF had non-detect results. The minimum cobalt concentration is from a laboratory-analyzed sample.

TABLE 5-6

05-Mar SUMMARY OF SAMPLING FOR OTHER SOILS[1]

Location	Number of Samples	Copper				Cobalt[4]				Arsenic			
		Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)
Panther Creek Road[2]	5	24	137	62	59	6	66	28	23	8	67	36	40
Soils in Areas Surrounding Waste-Rock Dumps[3, 4]	38	200	2100	557	450	400	4500	665	400	75	3500	407	310
Diversion Ditches Near Waste-Rock Dumps[3, 4, 5]	32	200	3300	1013	825	400	840	414	400	75	3800	373	75
Mine Road in Meadow Creek Basin	10	778	1380	1032	1000	120	300	180	170	302	1040	711	702
Mine Road in Bucktail Creek Basin	5	1430	2330	1920	1780	143	196	176	184	60	2430	1187	1320

Notes:

1. For soils not included as part of the waste-rock, debris flow, or overbank data sets. Detection limits were 400 mg/kg for copper, 800 mg/kg for cobalt, and 150 mg/kg for arsenic. Non-detect results were assigned a value equal to one-half the detection limit.
2. Data from CH2M Hill (1999).
3. Data from Golder (1996f).
4. Almost all of the samples tested below the detection limit for cobalt; therefore, the median and minimum reflect one-half the detection limit.
5. Many samples tested below the detection limit for arsenic; therefore, the median and minimum reflect one-half the detection limit.

TABLE 5-7

Comparison of Golder 1995 and 2000 Sediment Metal Concentrations (HCl/HNO_3 digestion)

Site	Date	Distance from Mouth	Arsenic	Cobalt	Copper	Iron	Manganese
		miles	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BB-18	08/17/1995	6	73.2	71.7	256	57500	468
BBSW-08	09/21/2000		28.7	17.5	422	32800	216
RPD			87%	122%	49%	55%	74%
BB-2A	08/16/1995	0.2	847	628	2490	49900	1100
BBSW-01	09/21/2000		555	426	1510	55700	826
RPD			42%	38%	49%	11%	28%
PCS Site 11-04	08/15/1995	21.5	72.8	264	450	25300	463
PASW-08	09/21/2000		203	130	141	16700	299
RPD			94%	68%	105%	41%	43%
PCS Site 10	08/17/1995	19.3	65.1	243	162	18700	383
PCS Site 10	08/17/1995		65.7	237	174	21700	387
PASW-07	09/21/2000		54.2	198	94.7	16900	343
RPD (using average Golder data)			19%	19%	56%	18%	12%
PCS Site 7	08/15/1995	12.9	93	117	1450	19100	215
PASW-05	09/21/2000		22.2	84.7	56.5	10600	230
RPD			122%	32%	185%	57%	7%
PCS Site 1	08/15/1995	1.3	10.2	54.6	55.9	20500	238
PASW-01	09/21/2000		10.1	48.1	62.1	10300	138
RPD			1%	13%	10%	66%	53%
SF-4	08/18/1995	0.6	20.8	19.4	86.4	22100	450
SFSW-04	09/21/2000		30	8.2	154	23100	509
RPD			36%	81%	56%	4%	12%
SF-1A	08/18/1995	0	448	499	7350	40700	497
SFSW-01	09/21/2000		176	366	6400	35500	488
RPD			87%	31%	14%	14%	2%
BD-8	08/16/1995	3.2	3.3	3.4	12	6590	116
BDSW-04	09/21/2000		1	1.4	29.7	4490	80.4
RPD			107%	83%	85%	38%	36%

RPD - relative percent difference.

Fall 2000 total metal data from HCl/HF digestion not included in comparison.

Table 5-8

Comparison of Sediment Total Metal Concentrations to PRG's

Station	Distance from Mouth	Date	% Solids	As mg/kg	Co mg/kg	Cu mg/kg
Blackbird Creek PRG				35	43	637
BBSW-08	6	09/21/2000	99.7	28.7	17.5	422
BBSW-08	6	10/16/2001		**44.2**	37.1	144
BBSW-07	4.5	09/21/2000	99.6	**663**	713	**3240**
BBSW-07	4.5	10/16/2001		**712**	717	**4250**
BBSW-03	3.3	09/21/2000	99.3	**1330**	346	**3320**
BBSW-03	3.3	10/16/2001		**978**	377	**2050**
BBSW-01	0.2	09/21/2000	99.1	555	426	**1510**
BBSW-01	0.2	10/16/2001		**563**	**546**	**709**
Panther Creek PRG				35	83	151
PASW-01	1.3	09/21/2000	99.9	10.1	48.1	62.1
PASW-01	1.3	10/16/2001		14.6	53.1	76.6
PASW-04	11.5	09/21/2000	99.9	**38.9**	60.8	**231**
PASW-04	11.5	10/16/2001		**40.1**	71.3	**313**
PASW-05	12.9	09/21/2000	99.8	22.2	**84.7**	56.5
PASW-05	12.9	10/16/2001		26.7	**91**	**181**
PASW-07	19.3	09/21/2000	99.8	**54.2**	**198**	94.7
PASW-07	19.3	10/16/2001		**115**	**154**	**201**
PASW-08	21.5	09/21/2000	99.6	**203**	**130**	141
PASW-08	21.5	10/16/2001		**152**	**246**	**300**
PASW-10	23.7	09/21/2000	99.8	**50**	79.1	61
PASW-10	23.7	10/16/2001		**83.7**	**86.5**	82.2
PASW-11	25	09/21/2000	99.5	6.4	3.1	39.5
PASW-11	25	10/16/2001		14.6	19.8	14.1
South Fork Big Deer Creek PRG				35	249	1637
SFSW-04	0.6	09/21/2000	99.5	30	8.2	**154**
SFSW-04	0.6	09/20/2001		27.4	12.1	312
SFSW-01	0	09/21/2000	99.8	**176**	366	**6400**
SFSW-01	0	09/20/2001		**158**	397	**7410**
Big Deer Creek PRG				35	383	151
BDSW-01	0	09/21/2000	100	5.7	69.8	**385**
BDSW-01	0	09/20/2001		5.5	53.8	**301**
BDSW-02	2.1	09/21/2000	99.9	7.1	37.4	**215**
BDSW-02	2.1	09/20/2001		12.6	40	**189**
BDSW-04	3.2	09/21/2000	99.9	1	1.4	29.7
BDSW-04		09/20/2001		2.1	2.3	12.7
Bucktail Creek						
BTSW-01.1	0.1	09/20/2001		228	776	10900
BTSW-02	2.1	09/20/2001		371	812	8716

Notes: --Results presented in **bold** exceeded In Stream Sediment PRG's
--No PRG's have been established for Bucktail Creek

Table 5-9

Summary of Periodic Sampling Results for Cobalt in Blackbird Creek (BBSW-01A) and Panther Creek (PASW-09)

		Cobalt	
		Dissolved	Total
Blackbird Creek Station	Date	Conc. (mg/L)	Conc. (mg/L)
BBSW-01A	12/22/2001	0.63	0.644
BBSW-01A	01/15/2002	0.666	0.676
BBSW-01A	02/18/2002	0.65	0.636
BBSW-01A	03/12/2002	0.674	0.691
BBSW-01A	03/15/2002	0.748	0.78
BBSW-01A	03/24/2002	0.541	0.571
BBSW-01A	04/09/2002	0.222	0.218
BBSW-01A	04/17/2002	0.157	0.162
BBSW-01A	04/24/2002	0.185	0.186
BBSW-01A	05/01/2002	0.11	0.114
BBSW-01A	05/06/2002	0.099	0.104
BBSW-01A	05/17/2002	0.082	0.092
BBSW-01A	05/23/2002	0.09	0.098
BBSW-01A	06/04/2002	0.1	0.102
BBSW-01A	06/21/2002	0.154	0.166
BBSW-01A	07/30/2002	0.209	0.22
BBSW-01A	08/19/2002	0.300	0.315
BBSW-01A	09/18/2002	0.462	0.499
BBSW-01A	10/18/2002	0.516	0.535
BBSW-01A	11/12/2002	0.581	0.582
PASW-09	12/22/2001	0.05	0.053
PASW-09	01/15/2002	0.062	0.064
PASW-09	02/18/2002	0.064	0.065
PASW-09	03/12/2002	0.099	0.107
PASW-09	03/15/2002	0.11	0.118
PASW-09	03/24/2002	0.079	0.087
PASW-09	04/09/2002	0.061	0.063
PASW-09	04/17/2002	0.05	0.053
PASW-09	04/24/2002	0.048	0.05
PASW-09	05/01/2002	0.032	0.034
PASW-09	05/06/2002	0.033	0.036
PASW-09	05/17/2002	0.026	0.03
PASW-09	05/23/2002	0.021	0.025
PASW-09	06/04/2002	0.016	0.021
PASW-09	06/21/2002	0.014	0.016
PASW-09	07/30/2002	0.015	0.02
PASW-09	08/19/2002	0.023	0.026
PASW-09	09/18/2002	0.044	0.045
PASW-09	10/18/2002	0.0448	0.049
PASW-09	11/07/2002	0.05(a)	
PASW-09	11/12/2002	0.0614	0.0621

(a) Sample collected by E. Modroo/IE

TABLE 5-10

Summary of Surface Water Reference Station Concentrations (mg/L) by Creek

Parameter	Location	1998		1999		2000	
		High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Cobalt (Dissolved)	ICSW-01					0.003 ND[a]	0.003 ND
	WFSW-02.5	0.007	0.006	0.003 ND	0.003 ND	0.003 ND	0.003 ND
	BBSW-08						0.003 ND
	PASW-11	0.002 ND	0.005	0.003 ND	0.003 ND	0.003 ND	0.003 ND
	SFSW-04					0.006	0.003 ND
	SFSW-03		0.002 ND	0.003 ND	0.003 ND	0.003 ND	
	BDSW-04		0.002 ND	0.003 ND	0.003 ND	0.007	0.003 ND
Copper (Dissolved)	ICSW-01					0.004	0.002 ND
	WFSW-02.5	0.007	0.002 ND	0.002 ND	0.002 ND	0.002 ND	0.002 ND
	BBSW-08						0.002 ND
	PASW-11	0.002 ND	0.002 ND	0.002 ND	0.008[b]	0.002 ND	0.002 ND
	SFSW-04					0.004	0.002 ND
	SFSW-03		0.01	0.02[c]	0.004[c]	0.005[c]	
	BDSW-04		0.002 ND	0.02[d]	0.01[e]	0.002 ND	0.002 ND
Iron (Total)	ICSW-01					0.04	0.1
	WFSW-02.5	0.5	0.2	0.2	0.1	0.1	0.07
	BBSW-08						0.06
	PASW-11	0.8	0.3	0.9	0.2	0.5	0.2
	SFSW-04					0.04	0.01 ND
	SFSW-03		0.010 ND	0.05	0.04	0.01 ND	
	BDSW-04		0.010 ND	0.2	0.01 ND	0.2	0.06

Notes:

[a]ND: Maximum exposure concentration is based on non-detected results (i.e., no results were reported above the detection limit). The value shown is one-half the detection limit.

[b]The dissolved copper value appears to be anomalous. This value appears to be the total copper value, rather than dissolved copper.

[c]Apparently anomalous results. The background station was moved upstream to SFSW-04 in 2000 to remove any possible interference from the lower Sediment Dam spillway.

[d]Apparently anomalous result. The dissolved sample results were greater than the total sample value, and copper was detected in the QA/QC blank sample.

[e]Apparently anomalous result. The downstream station (BDSW-03) had lower copper values than BDSW-04.

TABLE 5-11
Summary of 95% Upper Tolerance Levels for Background Sediment Data

Area	Parameter	Units	95% UTL
Mineralized	Arsenic	mg/kg	34.8
Mineralized	Cobalt	mg/kg	436
Mineralized	Copper	mg/kg	637
Mineralized	Iron	mg/kg	51,900
Panther Creek	Arsenic	mg/kg	34.8
Panther Creek	Cobalt	mg/kg	38.8
Panther Creek	Copper	mg/kg	87.4
Panther Creek	Iron	mg/kg	51,900

Notes:
UTL – Upper Tolerance Level

TABLE 5-12

SELECTED SUMMARY OF PRE-RI BACKGROUND SOIL CONCENTRATION DATA[1,2,3]

Location	Copper		Cobalt		Arsenic		Comment
	Min	Max	Min	Max	Min	Max	
Blacktail open pit area prior to mining disturbance	60	2400	10	400	NT	NT	371 samples; Median values: Cu = 150 ppm; Co = 60 ppm
Banks of Blackbird Creek above Meadow Creek	30	700	10	100	NT	NT	Transect of 66 samples; Median values: Cu = 100 ppm; Co = 20 ppm
North side of Blackbird mining area	4	479	6	273	NT	NT	
Forest topsoil north of open-pit waste pile	1268	1441	122	142	8	10	two samples
Indian Creek	11	541	9	436	NT	NT	
Elkhorn Creek	5	1500	<5	700	<5	900	nine samples
Lower Panther Creek Canyon	5	1500	7	10	<5	500	

Notes:

1. Adapted from Mebane (1994a); for undisturbed soils in the vicinity of Blackbird mining area.
2. All concentrations are in mg/kg dry weight unless noted otherwise.
3. NT means not tested.

TABLE 5-13

BACKGROUND SOIL CONCENTRATION DATA COLLECTED DURING THE RI [1]

Location	Copper		Cobalt		Arsenic		Comment
	Min	Max	Min	Max	Min	Max	
Riparian (n = 15; Medians: Cu =24.9; Co =14.4 ; As =17.6 . Mean values: Cu =122.3; Co =39.4; As =62.6)							
Big Deer Creek [2]	17.0	26.9	7.4	9.6	5.9	18.4	n = 2
Blacktail Ridge [2]	9.7		8.3		4.9		Single sample
East Blacktail Pit [2]	31.1	1425.0	14.2	314.0	11.1	637.5	n = 4
West Fork Blackbird Creek above Tailings Impoundment [2]	96.8		66.3		59.0		Single sample
Ludwig Gulch [2]	12.9	28.2	10.6	35.6	14.4	43.7	n = 6
Panther Creek Upstream of Blackbird Creek [2]	24.9		10.4		14.1		Single sample
Panther Creek Downstream of Panther Creek Inn [3]	14.0	71.7	4.0	62.0	12.4	57.8	n = 9; Medians: Cu = 27.2; Co = 18.5; As = 32.3. Mean values: Cu = 28.9; Co = 21.1; As = 29.8.
Borrow Soils [3]	15.7	130.0	12.7	71.6	7.7	158.0	n = 37; Medians: Cu = 35.5; Co = 29.4; As = 39.8. Mean values: Cu = 42.1; Co = 35.5; As = 48.6.

Notes:

1. All concentrations are in mg/kg dry weight.
2. From Golder (1996d). Concentrations for a sample are the average from the –10 and –200 fractions.
3. From Golder (1999b) and CH2M Hill (1999).

Table 5-14
Background Samples
Panther Creek Overbank Deposits
Blackbird Mine Site

Sample ID	Sampling Event	Arsenic Concentration (mg/kg)
CT-1	1998 Borrow Material	9.9
CT-2	1998 Borrow Material	2
CT-3	1998 Borrow Material	10.5
CT-4	1998 Borrow Material	17
CT-5	1998 Borrow Material	6
CT-6	1998 Borrow Material	14
CT-7	1998 Borrow Material	15.2
CT-8	1998 Borrow Material	13.4
CT-9	1998 Borrow Material	15.7
CT-10	1998 Borrow Material	33.5
CT-11	1998 Borrow Material	22.7
CT-12	1998 Borrow Material	7.7
CT-13	1998 Borrow Material	49.1
CT-14	1998 Borrow Material	2
990001	1999 Borrow Material	66.1
990002	1999 Borrow Material	62.9
990003	1999 Borrow Material	53.9
990004	1999 Borrow Material	39.8
990005	1999 Borrow Material	87.6
990006	1999 Borrow Material	158
990007	1999 Borrow Material	51.4
990008	1999 Borrow Material	31.2
990009	1999 Borrow Material	26.6
990010	1999 Borrow Material	131
990011	1999 Borrow Material	97
990012	1999 Borrow Material	26
990013	1999 Borrow Material	45.3
990014	1999 Borrow Material	39.1
990015	1999 Borrow Material	63.4
990016	1999 Borrow Material	15.5
990017	1999 Borrow Material	69.2
990018	1999 Borrow Material	50.1
990019	1999 Borrow Material	14.3
990020	1999 Borrow Material	43.8
990021	1999 Borrow Material	70.4
990022	1999 Borrow Material	62.9
990023	1999 Borrow Material	53.3
661564	1995 Riparian Background Areas	6.7
661565	1995 Riparian Background Areas	6.2
741573	1995 Riparian Background Areas	63.3
821584	1995 Riparian Background Areas	14.5
821585	1995 Riparian Background Areas	11.7
981380	1998 Overbank Deposit Areas	37.8
981358	1998 Overbank Deposit Areas	43

Table 5-14
Background Samples
Panther Creek Overbank Deposits
Blackbird Mine Site

Sample ID	Sampling Event	Arsenic Concentration (mg/kg)
981426	1998 Overbank Deposit Areas	57.8
981436	1998 Overbank Deposit Areas	32.3
981439	1998 Overbank Deposit Areas	19.1
981445	1998 Overbank Deposit Areas	17.9
981466	1998 Overbank Deposit Areas	15
981521	1998 Overbank Deposit Areas	32.5
981522	1998 Overbank Deposit Areas	32.3

Table 7-1
Surface Soil/Mine Wastes Exposure Assumptions
Record of Decision
Blackbird Mine Site

		Reasonable Maximum Exposure (RME) Scenario																
Exposure Parameter		Adult Occupational Worker Blackbird Mine	Adult Recreational Day-Users Blackbird Mine	Teen Recreational Day-Users Blackbird Mine	Adult Recreational Day-Users Upper Blackbird Creek	Child Recreational Day-Users Upper Blackbird Creek	Adult Occupational Worker Upper Blackbird Creek	Adult Recreational Day-Users Lower Blackbird Creek	Child Recreational Day-Users Lower Blackbird Creek	Adult Recreational Day-Users West Fork Blackbird Creek	Child Recreational Day-Users West Fork Blackbird Creek	Adult Occupational Worker West Fork Blackbird Creek	Adult Recreational Campers South Fork Big Deer Creek/ Big Deer Creek	Child Recreational Campers South Fork Big Deer Creek/ Big Deer Creek	Adult Recreational Day-Users South Fork Big Deer Creek/ Big Deer Creek	Child Recreational Day-Users South Fork Big Deer Creek/ Big Deer Creek	Adult Recreational Day-Users Bucktail Creek	Teen Recreational Day-Users Bucktail Creek
Exposure Frequency (days/year)	EF	167	7	7	7	7	7	14	14	14	14	7	14	14	14	14	7	7
Exposure Time (hours/day)	ET	2	2	2	2	2	2	2	2	2	2	2	16	14	2	2	2	2
Exposure Duration (years)	ED	25	30	6	30	6	25	30	6	30	6	25	30/6	30/6	30/6	30/6	30	6
Ingestion Rate (mg/day)	IngR	50	100	100	100	300	50	100	300	100	300	50	100	300	100	300	100	100
Inhalation Rate (m^3/day)	InhR	20	20	10	20	10	20	20	10	20	10	20	20	10	20	10	20	10
Skin Surface Area (cm^2)	SA	2,500	4,800	3,500	4,800	2,200	2,500	4,800	2,200	4,800	2,200	2,500	4,800	2,200	4,800	2,200	4,800	3,500
Body Weight (kg)	BW	70	70	45	70	15	70	70	15	70	15	70	70	15	70	15	70	45
Averaging Time for Carcinogens (yr)	ATc	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Averaging Time for Noncarcinogens (yr)	ATnc	30	30	6	30	6	30	30	6	30	6	30	30	6	30	6	30	6
Bioavailability Factor for Arsenic (unitless)	BAF	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1/Particulate Emission Factor (kg/m^3)	1/PEF	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10
Absorption Factor for Arsenic (unitless)	ABS	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Absorption Factor for other Inorganics (unitless)	ABS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soil-Skin Adherence Factor (mg/cm^2/day)	AF	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.2

Table 7-2
Sediment Exposure Assumptions
Record of Decision
Blackbird Mine Site

		Reasonable Maximum Exposure (RME) Scenario																
Exposure Parameter		Adult Occupational Worker Blackbird Mine	Adult Recreational Day-Users Blackbird Mine	Teen Recreational Day-Users Blackbird Mine	Adult Recreational Day-Users Upper Blackbird Creek	Child Recreational Day-Users Upper Blackbird Creek	Adult Occupational Worker Upper Blackbird Creek	Adult Recreational Day-Users Lower Blackbird Creek	Child Recreational Day-Users Lower Blackbird Creek	Adult Recreational Day-Users West Fork Blackbird Creek	Child Recreational Day-Users West Fork Blackbird Creek	Adult Occupational Worker West Fork Blackbird Creek	Adult Recreational Campers South Fork Big Deer Creek/ Big Deer Creek	Child Recreational Campers South Fork Big Deer Creek/ Big Deer Creek	Adult Recreational Day-Users South Fork Big Deer Creek/ Big Deer Creek	Child Recreational Day-Users South Fork Big Deer Creek/ Big Deer Creek	Adult Recreational Day-Users Bucktail Creek	Teen Recreational Day-Users Bucktail Creek
Exposure Frequency (days/year)	EF	167	7	7	7	7	7	14	14	14	14	7	14	14	14	14	7	7
Exposure Time (hours/day)[a]	ET	2	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1
Exposure Duration (years)	ED	25	30	6	30	6	25	30	6	30	6	25	30	6	30	6	30	6
Ingestion Rate (mg/day)	IngR	50	100	100	100	300	50	100	300	100	300	50	100	300	100	300	100	100
Inhalation Rate (m^3/day)	InhR	20	20	10	20	10	20	20	10	20	10	20	20	10	20	10	20	10
Skin Surface Area (cm^2)	SA	2,500	4,800	3,500	4,800	2,200	2,500	4,800	2,200	4,800	2,200	2,500	4,800	2,200	4,800	2,200	4,800	3,500
Body Weight (kg)	BW	70	70	45	70	15	70	70	15	70	15	70	70	15	70	15	70	45
Averaging Time for Carcinogens (yr)	ATc	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Averaging Time for Noncarcinogens (yr)	ATnc	30	30	6	30	6	30	30	6	30	6	30	30	6	30	6	30	6
Bioavailability Factor for Arsenic (unitless)	BAF	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
1/Particulate Emission Factor (kg/m_3)	1/PEF	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10	7.60E-10
Absorption Factor for Arsenic (unitless)	ABS	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Absorption Factor for other Inorganics (unitless)	ABS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soil-Skin Adherence Factor (mg/cm_2/day)	AF	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.1	0.2

Notes:

a : The exposure time for workers is based on the assumption that workers are outside 2 out of 8 hours per work day. The exposure time for the other scenarios is based on the assumption that adults are awake 16 hours per day, spending 1 hour contacting sediment and surface water, and children are awake 14 hours per day, while spending 2 hours contacting sediment and surface water.
b : The Panther Creek exposure area includes the Panther Creek Inn.

Table 7-3
Surface Water Exposure Assumptions
Record of Decision
Blackbird Mine Site

		Reasonable Maximum Exposure (RME) Scenario																
Exposure Parameter		Adult Occupational Worker Blackbird Mine	Adult Recreational Day-Users Blackbird Mine	Teen Recreational Day-Users Blackbird Mine	Adult Recreational Day-Users Upper Blackbird Creek	Child Recreational Day-Users Upper Blackbird Creek	Adult Occupational Worker Upper Blackbird Creek	Adult Recreational Day-Users Lower Blackbird Creek	Child Recreational Day-Users Lower Blackbird Creek	Adult Recreational Day-Users West Fork Blackbird Creek	Child Recreational Day-Users West Fork Blackbird Creek	Adult Occupational Worker West Fork Blackbird Creek	Adult Recreational Campers South Fork Big Deer Creek/ Big Deer Creek	Child Recreational Campers South Fork Big Deer Creek/ Big Deer Creek	Adult Recreational Day-Users South Fork Big Deer Creek/ Big Deer Creek	Child Recreational Day-Users South Fork Big Deer Creek/ Big Deer Creek	Adult Recreational Day-Users Bucktail Creek	Teen Recreational Day-Users Bucktail Creek
Exposure Frequency (days/year)	EF	167	7	7	7	7	7	14	14	14	14	7	14	14	14	14	7	7
Exposure Time (hours/day)[a]	ET	2	1	1	1	1	2	1	1	1	1	2	1	1	1	1	1	1
Exposure Duration (years)	ED	25	30	6	30	6	25	30	6	30	6	25	30	6	30	6	30	6
Ingestion Rate (L/day)	IngR	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Skin Surface Area (cm_2)	SA	2,500	4,800	3,500	4,800	2,200	2,500	4,800	2,200	4,800	2,200	2,500	4,800	2,200	4,800	2,200	4,800	3,500
Body Weight (kg)	BW	70	70	45	70	15	70	70	15	70	15	70	70	15	70	15	70	45
Averaging Time for Carcinogens (yr)	ATc	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Averaging Time for Noncarcinogens (yr)	ATnc	30	30	6	30	6	30	30	6	30	6	30	30	6	30	6	30	6
Bioavailability Factor for Arsenic (unitless)	BAF	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Conversion Factor (L/cm_3)	CF	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Chemical Specific Permeability Constant (cm/hr)	PC	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Notes:
a : The exposure time for workers is based on the assumption that workers are outside 2 out of 8 hours per work day. The exposure time for the other scenarios is based on the assumption that adults are awake 16 hours per day, spending 1 hour contacting sediment and surface water, and children are awake 14 hours per day, while spending 2 hours contacting sediment and surface water.
b : The Panther Creek exposure area includes the Panther Creek Inn.

Table 7-4
Surface Soil/Mine Wastes Exposure Point Concentrations
Record of Decision
Blackbird Mine Site

Exposure Area	Chemical	Units	Exposure Point Concentration	EPC Basis
Blackbird Mine	Arsenic	mg/kg	867	NORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/kg	1,379	NORM
	Iron	mg/kg	78,412	NORM
Upper Blackbird Creek	Arsenic	mg/kg	4,918	LOGNORM
	Cobalt	mg/kg	2,111	LOGNORM
	Copper	mg/kg	1,222	LOGNORM
	Iron	mg/kg	113,346	LOGNORM
	Manganese	mg/kg	4,647	LOGNORM
Lower Blackbird Creek	Arsenic	mg/kg	2,010	LOGNORM
	Cobalt	mg/kg	23,492	NORM
	Copper	mg/kg	1,088	LOGNORM
	Iron	mg/kg	66,156	LOGNORM
	Manganese	mg/kg	25,619	LOGNORM
West Fork Blackbird Creek	Arsenic	mg/kg	2,205	LOGNORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
	Iron	- Iron was not identified as a COC -		
	Manganese	- Manganese was not identified as a COC -		
	Nickel	- Nickel was not identified as a COC -		
	Zinc	- Zinc was not identified as a COC -		
Bucktail Creek	Arsenic	mg/kg	572	NORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
South Fork Big Deer Creek/Big Deer Creek	Arsenic	mg/kg	108	LOGNORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/kg	7,544	LOGNORM
	Iron	- Iron was not identified as a COC -		
Panther Creek	-- Risks from exposure to surface soil in the Panther Creek exposure area are addressed in Attachment 1, Panther Creek Inn, and Attachment 2, Panther Creek Overbank Deposits --			

Notes:
EPC : Exposure Point Concentration
NORM : Exposure Point Concentration is based on the 95% Upper Confidence Limit assuming a normal distribution.
LOGNORM : Exposure Point Concentration is based on the 95% Upper Confidence Limit assuming a lognormal distribution.
NA : Not applicable. There are no detects, therefore a EPC is not calculated.
MAXDET(< MinNumSamples) : Maximum detected concentration is used when there are less than 10 samples in the data set.

Table 7-5
Sediment Exposure Point Concentrations
Record of Decision
Blackbird Mine Site

Exposure Area	Compound	Units	Exposure Point Concentration	Basis
Blackbird Mine	Arsenic	- Arsenic was not identified as a COC -		
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
	Iron	mg/kg	32,800	MAXDET (<MinNumSamps)
	Manganese	- Manganese was not identified as a COC -		
Upper Blackbird Creek	Arsenic	mg/kg	1,134	NORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/kg	3,579	LOGNORM
	Iron	mg/kg	81,161	LOGNORM
	Manganese	- Manganese was not identified as a COC -		
Lower Blackbird Creek	Arsenic	mg/kg	1,132	NORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/kg	2,886	NORM
	Iron	mg/kg	80,973	NORM
	Manganese	mg/kg	1,569	NORM
West Fork Blackbird Creek	Arsenic	mg/kg	1,230	MAXDET (<MinNumSamps)
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
	Iron	mg/kg	97,000	MAXDET (<MinNumSamps)
	Manganese	- Manganese was not identified as a COC -		
Bucktail Creek	Arsenic	mg/kg	371	MAXDET (<MinNumSamps)
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/kg	10,900	MAXDET (<MinNumSamps)
	Iron	- Iron was not identified as a COC -		
	Manganese	- Manganese was not identified as a COC -		
South Fork Big Deer Creek/Big Deer Creek	Arsenic	mg/kg	78	LOGNORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/kg	5644	LOGNORM
	Iron	mg/kg	24773	LOGNORM
	Manganese	Manganese was not identified as a COC		
Panther Creek	Arsenic	mg/kg	73	NORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
	Iron	mg/kg	20,104	LOGNORM
	Manganese	mg/kg	1,714	LOGNORM

Notes:
EPC : Exposure Point Concentration
NORM : Exposure Point Concentration is based on the 95% Upper Confidence Limit assuming a normal distribution.
LOGNORM : Exposure Point Concentration is based on the 95% Upper Confidence Limit assuming a lognormal distribution.
MAXDET : Maximum detected concentration is used as the EPC.

Table 7-6
Surface Water Exposure Point Concentrations
Record of Decision
Blackbird Mine Site

Exposure Area	Compound	Units	Exposure Point Concentration	Basis
Blackbird Mine	Arsenic	mg/L	0.17	LOGNORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
	Iron	mg/L	61.22	LOGNORM
	Manganese	mg/L	3.0	LOGNORM
Upper Blackbird Creek	Arsenic	mg/L	0.02	LOGNORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	mg/L	1.03	LOGNORM
	Iron	mg/L	5.16	LOGNORM
	Manganese	- Manganese was not identified as a COC -		
Lower Blackbird Creek	Arsenic	mg/L	0.03	LOGNORM
	Cobalt	- Cobalt was not identified as a COC -		
	Copper	- Copper was not identified as a COC -		
	Iron	mg/L	5.54	LOGNORM
	Manganese	- Manganese was not identified as a COC -		
West Fork Blackbird Creek	Arsenic	mg/L	0.01	LOGNORM
	Cobalt	mg/L	6.02	MAXDET
	Copper	mg/L	1.06	MAXDET
	Iron	mg/L	114	MAXDET
	Manganese	mg/L	3.85	MAXDET
Bucktail Creek	Arsenic	mg/L	0.02	LOGNORM
	Cobalt	mg/L	3.1	NORM
	Copper	mg/L	9	NORM
	Manganese	mg/L	1.8	LOGNORM
South Fork Big Deer Creek/Big Deer Creek	Arsenic	no COCs were identified for the South Fork Big Deer Creek/Big Deer Creek exposure area		
	Cobalt			
	Copper			
	Iron			
	Manganese			
Panther Creek	Arsenic	no COCs were identified for the Panther Creek exposure area		
	Cobalt			
	Copper			
	Iron			
	Manganese			

Notes:
EPC : Exposure Point Concentration
NORM : Exposure Point Concentration is based on the 95% Upper Confidence Limit assuming a normal distribution.
LOGNORM : Exposure Point Concentration is based on the 95% Upper Confidence Limit assuming a lognormal distribution.
MAXDET : Maximum detected concentration is used as the EPC.

Table 7-7
Risk Characterization Summary - Surface Soil/Mine Wastes
Record of Decision
Blackbird Mine Site

Exposure Area/Receptor	Reasonable Maximum Exposure		Central Tendency Exposure	
	Cancer Risk	NonCancer Hazard Index	Cancer Risk	NonCancer Hazard Index
Blackbird Mine				
Adult Worker	3E-05	0.2	6E-06	0.1
Adult Day-User	2E-06	0.01	9E-07	1E-04
Teen Day-User	--	0.02	--	5E-04
Age-Adjusted Day-User	1E-05	--	1E-06	--
Upper Blackbird Creek				
Adult Day-User	9E-06	0.05	7E-07	0.01
Child Day-User	--	0.6	--	0.1
Age-Adjusted Day-User	3E-05	--	5E-06	--
Adult Worker	8E-06	0.06	1E-06	0.03
Lower Blackbird Creek				
Adult Day-User	8E-06	0.1	2E-07	0.03
Child Day-User	--	0.7	--	0.2
Age-Adjusted Day-User	2E-05	--	5E-06	--
West Fork Blackbird Creek				
Adult Day-User	4E-06	0.02	2E-07	0.01
Child Day-User	--	0.5	--	0.1
Age-Adjusted Day-User	3E-05	--	3E-06	--
Adult Worker	4E-06	0.03	1E-06	0.01
Bucktail Creek				
Adult Day-User	1E-06	0.008	2E-07	0.004
Teen Day-User	--	0.01	--	0.01
Age-Adjusted Day-User	6E-06	--	8E-07	--
South Fork/Big Deer Creek				
Adult Camper	3E-06	0.03	6E-07	0.003
Child Camper	--	0.3	--	0.04
Age-Adjusted Camper	3E-06	--	1E-06	--
Adult Day-User	4E-07	0.005	4E-08	0.002
Child Day-User	--	0.05	--	0.01
Age-Adjusted Day-User	1E-06	--	3E-07	--
Panther Creek				
Adult Day-User	-- Risks from exposure to surface soil in the Panther Creek exposure area are addressed in Attachment 1, Panther Creek Inn, and Attachment 2, Panther Creek Overbank Deposits --			
Child Day-User				
Age-Adjusted Day-User				

Notes:
NC = Not calculated; no Chemicals of Concern (COCs) were identified.
-- : Age-Adjusted cancer risk estimates including exposures to both adult and child receptors and are used to represent potential risk to child receptors. However, age-adjusted noncancer risks estimates are superceded by the child noncancer risk estimates.
Bolded results indicate an exceedance of U.S. EPA's target risk range of 1E-04 (1×10^{-4}) to 1E-06 (1×10^{-6}) or HI of 1.

Table 7-8
Summary of Risk Calculations - Sediment
Record of Decision
Blackbird Mine Site

Exposure Area/Receptor	Reasonable Maximum Exposure		Central Tendency Exposure	
	Cancer Risk	NonCancer Hazard Index	Cancer Risk	NonCancer Hazard Index
Blackbird Mine				
Adult Worker	NC	0.02	NC	0.002
Adult Day-User	NC	5E-04	NC	5E-05
Teen Day-User	--	0.002	--	1E-04
Age-Adjusted Day-User	NC	--	NC	--
Upper Blackbird Creek				
Adult Day-User	9E-07	0.01	7E-08	0.001
Child Day-User	--	0.08	--	0.017
Age-Adjusted Day-User	5E-06	--	1E-06	--
Adult Worker	3E-06	0.02	8E-07	0.001
Lower Blackbird Creek				
Adult Day-User	2E-06	0.01	2E-07	0.003
Child Day-User	--	0.06	--	0.041
Age-Adjusted Day-User	1E-05	--	2E-06	--
West Fork Blackbird Creek				
Adult Day-User	1E-06	0.07	8E-08	0.001
Child Day-User	--	0.09	--	0.018
Age-Adjusted Day-User	6E-06	--	1E-06	--
Adult Worker	4E-06	0.03	9E-07	0.005
Bucktail Creek				
Adult Day-User	3E-07	0.00	2E-08	0.000
Teen Day-User	--	0.02	--	0.004
Age-Adjusted Day-User	2E-06	--	3E-07	--
South Fork Big Deer Creek/Big Deer Creek				
Adult Camper	1E-07	0.001	1E-08	0.0004
Child Camper	--	0.02	--	0.006
Age-Adjusted Camper	7E-07	--	2E-07	--
Adult Day-User	1E-07	0.001	1E-08	0.0004
Child Day-User	--	0.02	--	0.006
Age-Adjusted Day-User	7E-07	--	2E-07	--
Panther Creek				
Adult Day-User	1E-07	0.001	1E-08	0.0003
Child Day-User	--	0.02	--	0.004
Age-Adjusted Day-User	7E-07	--	2E-07	--

Notes:
NC = Not calculated; no Chemicals of Concern (COCs) were identified.
-- : Age-Adjusted cancer risk estimates including exposures to both adult and child receptors and are used to represent potential risk to child receptors. However, age-adjusted noncancer risks estimates are superceded by the child noncancer risk estimates.
Bolded results indicate an exceedance of U.S. EPA's target risk range of 1E-04 (1×10^{-4}) to 1E-06 (1×10^{-6}) or HI of 1.

Table 7-9
Summary of Risk Calculations - Surface Water
Record of Decision
Blackbird Mine Site

Exposure Area/Receptor	Reasonable Maximum Exposure		Central Tendency Exposure	
	Cancer Risk	NonCancer Hazard Index	Cancer Risk	NonCancer Hazard Index
Blackbird Mine				
Adult Worker	1E-05	0.07	8E-07	0.02
Adult Day-User	1E-05	0.07	8E-07	0.02
Teen Day-User	--	0.004	--	2E-04
Age-Adjusted Day-User	7E-07	--	7E-07	--
Upper Blackbird Creek				
Adult Day-User	1E-08	0.0001	9E-10	3E-05
Child Day-User	--	0.0001	--	2E-04
Age-Adjusted Day-User	2E-07	--	9E-08	--
Adult Worker	4E-08	3E-04	3E-09	5E-04
Lower Blackbird Creek				
Adult Day-User	4E-08	0.0004	8E-07	1E-04
Child Day-User	--	0.002	--	2E-03
Age-Adjusted Day-User	2E-07	--	3E-07	--
West Fork Blackbird Creek				
Adult Day-User	NC	0.009	NC	5E-04
Child Day-User	--	0.002	--	0.002
Age-Adjusted Day-User	NC	--	NC	--
Adult Worker	NC	0.002	NC	5E-04
Bucktail Creek				
Adult Day-User	1E-08	4E-04	1E-09	9E-05
Teen Day-User	--	0.002	--	7E-05
Age-Adjusted Day-User	2E-07	--	1E-07	--
South Fork Big Deer Creek/Big Deer Creek				
Adult Camper	-- NC : no COCs identified --			
Child Camper				
Age-Adjusted Camper				
Adult Camper				
Child Camper				
Age-Adjusted Camper				
Panther Creek				
Adult Day-User	-- NC : no COCs identified --			
Child Day-User				
Age-Adjusted Day-User				

Notes:
NC = Not calculated; no Chemicals of Concern (COCs) were identified.
-- : Age-Adjusted cancer risk estimates including exposures to both adult and child receptors and are used to represent potenti. risk to child receptors. However, age-adjusted noncancer risks estimates are superceded by the child noncancer risk estimate
Bolded results indicate an exceedance of U.S. EPA's target risk range of 1E-04 (1×10^{-4}) to 1E-06 (1×10^{-6}) or HI of 1.

Table 7-10
Summary of Cumulative Risk Assessments Results (Surface Soil/Mine Wastes, Sediment, and Surface Water)
Record of Decision
Blackbird Mine Site

Exposure Scenario/ Receptor	Reasonable Maximum Exposure		Central Tendency Exposure	
	Cancer Risk	NonCancer Hazard Index	Cancer Risk	NonCancer Hazard Index
Blackbird Mine				
Adult Worker	4E-05	0.3	7E-06	0.1
Adult Day-User	1E-05	0.08	2E-06	0.02
Teen Day-User	--	0.02	--	8E-04
Age-Adjusted Day-User	1E-05	--	2E-06	--
Upper Blackbird Creek				
Adult Day-User	1E-05	0.1	8E-07	0.0
Child Day-User	--	0.7	--	0.2
Age-Adjusted Day-User	3E-05	--	6E-06	--
Adult Worker	1E-05	0.1	2E-06	0.03
Lower Blackbird Creek				
Adult Day-User	9E-06	0.1	1E-06	0.03
Child Day-User	--	0.7	--	0.2
Age-Adjusted Day-User	3E-05	--	8E-06	--
West Fork Blackbird Creek				
Adult Day-User	5E-06	0.1	3E-07	0.01
Child Day-User	--	0.6	--	0.1
Age-Adjusted Day-User	3E-05	--	4E-06	--
Adult Worker	7E-06	0.1	2E-06	0.0
Bucktail Creek				
Adult Day-User	2E-06	0.01	3E-07	0.00
Child Day-User	--	0.03	--	0.0
Age-Adjusted Day-User	7E-06	--	1E-06	--
South Fork Big Deer Creek/Big Deer Creek				
Adult Camper	3E-06	0.03	6E-07	0.003
Child Camper	--	0.3	--	0.04
Age-Adjusted Camper	4E-06	--	2E-06	--
Adult Day-User	5E-07	0.006	5E-08	0.002
Child Day-User	--	0.1	--	0.02
Age-Adjusted Day-User	2E-06	--	4E-07	--
Panther Creek (Sediment and Surface Water Only)				
Adult Day-User	1E-07	0.001	1E-08	3E-04
Child Day-User	--	0.02	--	0.004
Age-Adjusted Day-User	7E-07	--	2E-07	--

Notes:
NC = Not calculated; no Chemicals of Concern (COCs) were identified.
-- : Age-Adjusted cancer risk estimates including exposures to both adult and child receptors and are used to represent potential risk to child receptors. However, age-adjusted noncancer risks estimates are superceded by the child noncancer risk estimates.
Bolded results indicate an exceedance of U.S. EPA's target risk range of 1E-04 (1×10^{-4}) to 1E-06 (1×10^{-6}) or HI of 1.

TABLE 8-2
Recreational Exposure Factors
Blackbird Mine Site

Symbol	Definition (units)	Day-User at Upper Blackbird Creek	Day-User at Lower Blackbird Creek
TR	Target Risk	1×10^{-4}	1×10^{-4}
THI	Target Hazard Index	1	1
Atc	Averaging Time –cancer (days)	25,550	25,550
Atnc	Averaging Time – noncancer (days)	2,190	2,190
BW	Body Weight – Child (kg)	15	15
EF	Exposure Frequency (days/year)	7	14
ET	Exposure Time (hours/day)	2	2
ED	Exposure Duration – child (years)	6	6
Irs	Ingestion Rate – child (mg/day)	300	300
Iradj	Ingestion Rate – age-adjusted (mg-yr/kg-d)	154	154
FI	Fraction Ingested (unitless)	1	1
CF	Conversion Factor (kg/mg)	1×10^{-6}	1×10^{-6}
BAF	Bioavailability Factor (unitless)	0.6	0.6
InhRadj	Air Inhalation Rate – age-adjusted (m^3-yr/kg-day)	11	11
InhRchild	Air Inhalation Rate – child (m^3/day)	10	10
1/PEF	1/Particulate Emission Factor (kg/m^3)	7.6×10^{-10}	7.6×10^{-10}
SCF	Skin Contact Factor-age-adjusted (mg-yr/kg-day)	341	341
Sachild	Skin Surface Area – child (cm^2/day)	2,200	2,200
BAF	Bioavailability Factor – arsenic	0.60	0.60
ABS	Absorption Factor (unitless)	0.03	0.03
AF	Adherence Factor - child (mg/cm^2)	0.2	0.2

TABLE 10-1
Evaluation Summary for Blackbird Creek Alternatives

Alternative / Criteria	BB-1 No Further Action	BB-4 Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment; Stabilization with Selective Removal of Overbank Deposits; Natural Recovery for In-Stream Sediments	BB-5 Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment and Treat Tailings Impoundment Seepage; Stabilization with Selective Removal of Overbank Deposits; Natural Recovery for In-Stream Sediments	BB-6 Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment; Removal with Selective Stabilization of Overbank Deposits; Natural Recovery for In-Stream Sediments	BB-7 Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment and Treat Tailings Impoundment Seepage; Removal with Selective Stabilization of Overbank Deposits; Natural Recovery for In-Stream Sediments	BB-8 Meadow Creek Seep Collection; Cap Tailings Impoundment and Treat Tailings Impoundment Seepage; Complete Removal of Overbank Deposits and In-Stream Sediments
Overall Protection	Not protective of human health or the environment	Protective of human health. May periodically exceed water quality cleanup goals in Panther Creek. Stabilization of overbank deposits may not provide as good overall protection as alternatives that include more removal.	Protective of human health. May periodically exceed copper and cobalt cleanup goals in Panther Creek. Stabilization of overbank deposits may not provide as good overall protection as alternatives that include more removal.	Protective of human health. Meets copper cleanup goals in Panther Creek. Uncertainty in terms of meeting cobalt cleanup goals in Panther Creek, and would require years to decades. Removal of overbank deposits likely to provide better overall protection than alternatives that rely primarily on stabilization.	Protective of human health and the environment. Meets copper and cobalt cleanup goals in Panther Creek. Removal of overbank deposits likely to provide better overall protection than alternatives that rely primarily on stabilization.	Protective of human health and the environment in long-term. Meets copper and cobalt cleanup goals in Panther Creek. This alternative would result in signficant short-term impacts to the environment with no significant improvements to water quality.
Compliance with ARARs	Currently does not consistently meet copper water quality standard in Panther Creek. Meets all other ARARs.	Periodic exceedance of copper water quality standard in Panther Creek likely. Maximum mixing zone of 48% for copper and 100% for cobalt in Panther Creek (average conditions). Meets all other ARARs	Occasional springtime exceedance of copper water quality standard in Panther Creek likely. Maximum mixing zone of 48% for copper and 85% for cobalt in Panther Creek (average conditions) Meets all other ARARs.	Expected to consistently achieve copper water quality standard in Panther Creek. Maximum mixing zone of 30% for copper and 100% for cobalt in Panther Creek (average conditions) Meets all other ARARs	Expected to consistently achieve copper water quality standard in Panther Creek. Maximum mixing zone of 30% for copper and 70% for cobalt in Panther Creek (average conditions) Meets all other ARARs	Expected to consistently achieve copper water quality standard in Panther Creek. Maximum mixing zone of 30% for copper and 65% for cobalt in Panther Creek (average conditions) Meets all other ARARs
Long-Term Effectiveness	Does not consistently meet water quality cleanup goals. Existing controls inadequate to protect against residual risks. Not effective in long-term	Not expected to consistently achieve water quality objectives. Capping at West Fork Impoundment not as reliable or certain as treatment for meeting cobalt cleanup goal in Panther Creek. Physical stabilization not as reliable as removal for overbank deposits.	Not expected to consistently achieve water quality objectives. Treatment at West Fork Impoundment more reliable and certain than capping for meeting cobalt cleanup goal in Panther Creek. Physical stabilization not as reliable as removal for overbank deposits.	Not expected to consistently achieve water quality objectives. Expected to meet copper cleanup goal in Panther Creek; capping at West Fork Impoundment not as reliable or certain as treatment for meeting cobalt cleanup goal in Panther Creek. Removal of overbank deposits more effective and reliable than physical stabilization.	Expected to consistently achieve water quality objectives. Treatment at West Fork Impoundment more reliable and certain than capping for meeting cobalt cleanup goal in Panther Creek. Removal of overbank deposits more effective and reliable than physical stabilization.	Expected to consistently achieve water quality objectives. Treatment at West Fork Impoundment more reliable and certain than capping for meeting cobalt cleanup goal in Panther Creek. Removal of all in-stream and overbank deposits most reliable in long-term.
Reduction in Toxicity, Mobility, Volume Through Treatment	No additional treatment provided	Treatment of Meadow Creek seepage	Treatment of Meadow Creek seepage and Tailings Impoundment seepage	Treatment of Meadow Creek seepage	Treatment of Meadow Creek seepage and Tailings Impoundment seepage	Treatment of Meadow Creek seepage and Tailings Impoundment seepage
Short-Term Effectiveness	Does not create the short-term construction risks	Short-term construction risks similar for Alternatives BB-4 through BB-7.	Short-term construction risks similar for Alternatives BB-4 through BB-7.	Short-term construction risks similar for Alternatives BB-4 through BB-7. May require years to a decade or more to achieve cobalt cleanup goals in Panther Creek.	Short-term construction risks similar for Alternatives BB-4 through BB-7. Would meet all cleanup goals within 1 to 2 years after implementation.	Extensive short-term environmental impacts for up to a decade until riparian vegetation recovers. Would require greatest time to implement (3 or more years).
Implementability	No implementation required	Readily implemented. Physical stabilization more difficult than removal because large riprap difficult to locate. Capping at West Fork less difficult than treatment.	Readily implemented. Physical stabilization more difficult than removal because large riprap difficult to locate. Treatment at West Fork more difficult than capping.	Readily implemented; less difficult than all other alternatives except No Further Action	Readily implemented. Treatment at West Fork more difficult than capping.	Very difficult to implement. Would require extensive sediment controls and excavation below the water table. Would require siting of new disposal facility.
Cost (millions, net present value)	$1.2	$4.2	$6.4 to $9.9 (a)	$4.6	$6.8 to $10.2 (a)	$52.7 to $56.2 (a)

(a) Costs depend on treatment option for groundwater at the West Fork Tailings Impoundment (see Table 10-4 and Tables 12-1 through 12-3 for details)

TABLE 10-2
Evaluation Summary for Bucktail Creek Alternatives

Alternative / Criteria	BT-1 No Further Action	BT-3 Seep Collection and Treatment; Natural Recovery of Sediments	BT-4 Seep Collection and Treatment; S. Fork Big Deer Creek Sediment Removal; Natural Recovery of Remaining Sediments	BT-5 Seep Collection and Treatment; Diversion of Bucktail Creek; Natural Recovery of Sediments	BT-6 Seep Collection and Treatment; Complete Sediment Removal
Overall Protection	Protective of human health. Would not meet water quality cleanup goals in South Fork or Big Deer Creeks.	Protective of human health. Would meet cleanup goals in Big Deer Creek. Would not meet cleanup goals in So. Fork Big Deer Creek.	Protective of human health. Would meet cleanup goals Big Deer Creek, but not in South Fork. Removal of sediments in So. Fork would not significantly improve time to meet cleanup goals in So. Fork Big Deer Creek.	Protective of human health. Would meet cleanup goals in Big Deer Creek. Diversion of Bucktail Creek would allow cleanup goals to be met in So. Fork Big Deer Creek.	Protective of human health. Would meet cleanup goals Big Deer Creek, but not in South Fork. Removal of all sediments would result in significant short-term impacts to the environment.
Compliance with ARARs	Would not meet copper ARAR in South Fork or Big Deer Creeks. Meets all other ARARs	Would meet copper water quality ARAR in Big Deer Creek, but not in South Fork Creek. Maximum mixing zone for copper in Big Deer Creek is 70 to 100% (average conditions), depending on effectiveness of Bucktail seep collection. Meets all other ARARs	Would meet copper water quality ARAR in Big Deer Creek, but not in South Fork Creek. Maximum mixing zone for copper in Big Deer Creek is 70 to 100% (average conditions), depending on effectiveness of Bucktail seep collection. Meets all other ARARs	Would meet copper ARAR in both South Fork and Big Deer Creeks. Maximum mixing zone for copper in Big Deer Creek is 70 to 100% (average conditions), depending on effectiveness of Bucktail seep collection. Meets all other ARARs	Would meet copper water quality ARAR in Big Deer Creek, but not in South Fork Creek. Maximum mixing zone for copper in Big Deer Creek is 70 to 100% (average conditions), depending on effectiveness of Bucktail seep collection. Meets all other ARARs
Long-Term Effectiveness	Not effective or reliable in long term.	Would be effective and reliable in long-term for meeting cleanup goals in Big Deer Creek. Would not meet cleanup goals in South Fork.	Would be effective and reliable in long-term for meeting cleanup goals in Big Deer Creek. Would not meet cleanup goals in South Fork. Bucktail Creek sediments or water could recontaminate the replacement South Fork sediments.	Would be effective and reliable in long-term for meeting cleanup goals in both South Fork and Big Deer Creeks.	Would be effective and reliable in long-term for meeting cleanup goals in Big Deer Creek. Would not meet cleanup goals in South Fork. Bucktail Creek sediments or water could recontaminate the replacement South Fork and Big Deer Creek sediments.
Reduction in Toxicity, Mobility, Volume Through Treatment	No additional treatment provided	Treatment of Bucktail seepage	Treatment of Bucktail seepage	Treatment of Bucktail seepage	Treatment of Bucktail seepage
Short-Term Effectiveness	Does not create the short-term construction risks	Flushing of Bucktail Creek sediments may result in exceedances of cleanup goals in Big Deer Creek until the sediments are flushed (a). There would be some short term construction risks for seepage collection system.	Flushing of Bucktail Creek sediments may result in exceedances of cleanup goals in Big Deer Creek until the sediments are flushed (a). Short term construction risks would be increased to remove sediments from So. Fork Big Deer Creek.	Flushing of Bucktail Creek sediments may result in exceedances of cleanup goals in Big Deer Creek until the sediments are flushed (a). cleanup goals should be met in South Fork within 2-5 years. There would be some short term construction risks for seepage collection system.	Would meet cleanup goals in Big Deer within 1-2 years of completion. Would not meet cleanup goals in South Fork. Would require 3 to 5 years for construction. Extensive short-term construction impacts to stream channels and riparian vegetation would require decade or more for recovery
Implementability	No implementation required	There will be some technical challenges intercepting sufficient seepage to meet cleanup goals.	Difficult to implement. Would require extensive sediment controls and excavation below the water table in South Fork. There will be some technical challenges intercepting sufficient seepage to meet cleanup goals.	There will be some technical challenges intercepting sufficient seepage to meet cleanup goals.	Very difficult to implement. Would require extensive sediment controls and excavation below the water table. There will be some technical challenges intercepting sufficient seepage to meet cleanup goals. Would require siting of new disposal facility.
Cost (millions, net present value)	$1.2	$4.4	$5.0	$4.7	$11.3

(a) The timing for Bucktail Creek sediment flushing is uncertain, but may be years to a decade or more. If water quality cleanup goals are not consistently met in Big Deer Creek in an acceptable time frame, alternatives for contingencies to address water quality will be evaluated.

TABLE 10-3
Evaluation Summary for Panther Creek Alternatives

Alternative / Criteria	P-1 No Further Action	P-2 Natural Recovery with Institutional Controls and Monitoring	P-3 Selective Overbank Deposit Removal
Overall Protection	Not guaranteed	Overall protection relies on effectiveness of institutional controls and monitoring	Removal of deposits exceeding human health PRGs ensures overall protectiveness
Compliance with ARARs	Yes	Yes	Yes
Long-Term Effectiveness	Potential unacceptable risk under future residential land use scenario.	Effective and reliable for current and future land uses if institutional controls are maintained.	Effective and reliable for current and future land uses.
Reduction in Toxicity, Mobility, Volume Through Treatment	None	None	None
Short-Term Effectiveness	Does not create the short-term risks of Alternative P-3.	Does not create the short-term risks of Alternative P-3.	Removal creates potential short-term risks to the community, site workers, and the environment during implementation.
Implementability	No implementation required	Implementable as long as an appropriate entity is willing to serve as grantee of the land restriction instrument(s) and private property owners are willing to accept ICs.	Readily implemented
Cost (millions, net present value)	$0.0	$0.4	$1.6

NOTE: Water quality improvements in Panther Creek determined by alternatives selected for Blackbird Creek and for Bucktail Creek.

TABLE 10-4
SUMMARY OF ESTIMATED ALTERNATIVE COSTS

Alternative		Estimated Costs (millions) [a]		
		Capital	Annual [b]	Total
Blackbird Creek (incl. Tailings Impoundment)				
BB-1	No Further Action	$0.0	$1.2	$1.2
BB-4	Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment; Stabilization with Selective Removal of Overbank Deposits; Natural Recovery for In-Stream Sediments	$2.1	$2.0	$4.2
BB-5	Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment and Treat Tailings Impoundment Seepage; Stabilization with Selective Removal of Overbank Deposits; Natural Recovery for In-Stream Sediments			
a	Treat Tailings Impoundment Seepage with Passive In-Situ	$3.2	$3.2	$6.4
b	Treat Tailings Impoundment Seepage with Active In-Situ	$4.7	$4.8	$9.5
c	Treat Tailings Impoundment Seepage at WTP	$5.3	$4.5	$9.9
BB-6	Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment; Removal with Selective Stabilization of Overbank Deposits; Natural Recovery for In-Stream Sediments	$2.7	$1.9	$4.6
BB-7	Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment and Treat Tailings Impoundment Seepage; Removal with Selective Stabilization of Overbank Deposits; Natural Recovery for In-Stream Sediments			
a	Treat Tailings Impoundment Seepage with Passive In-Situ	$3.7	$3.0	$6.8
b	Treat Tailings Impoundment Seepage with Active In-Situ	$5.2	$4.7	$9.9
c	Treat Tailings Impoundment Seepage at WTP	$5.9	$4.4	$10.2
BB-8	Meadow Creek Seep Collection; Cap West Fork Tailings Impoundment and Treat Tailings Impoundment Seepage; Complete Removal of Overbank Deposits and In-Stream Sediments			
a	Treat Tailings Impoundment Seepage with Passive In-Situ	$49.1	$3.7	$52.7
b	Treat Tailings Impoundment Seepage with Active In-Situ	$50.5	$5.3	$55.8
c	Treat Tailings Impoundment Seepage at WTP	$51.2	$5.0	$56.2
Bucktail, S. Fork Big Deer, and Big Deer Creeks				
BT-1	No Further Action	$0.0	$1.2	$1.2
BT-3	Seep Collection and Treatment; Natural Recovery of Sediments	$2.0	$2.4	$4.4
BT-4	Seep Collection and Treatment; S. Fork Big Deer Creek Sediment Removal; Natural Recovery of Remaining Sediments	$2.6	$2.4	$5.0
BT-5	Seep Collection and Treatment; Diversion of Bucktail Creek; Natural Recovery of Sediments	$2.3	$2.4	$4.7
BT-6	Seep Collection and Treatment; Complete Sediment Removal	$8.4	$2.9	$11.3
Panther Creek				
P-1	No Further Action	$0.0	$0.0	$0.0
P-2	Natural Recovery with Institutional Controls and Monitoring	$0.1	$0.3	$0.4
P-3	Selective Overbank Deposit Removal; Natural Recovery of In-Stream Sediments	$1.4	$0.2	$1.6

[a] Costs are for early 2002.

[b] Net present value of future costs (O&M monitoring) at 7% discount rate for 30 years.

Table 10-4.xls, Cost Summ

After Golder Associates

TABLE 12-1
ESTIMATED COST FOR ALTERNATIVE BB-7a

Item	Quantity	Units	Unit Cost	Cost [a]	Notes
CAPITAL COSTS					
Collect Meadow Creek seeps				$116,000	See FS Table E-18
Tailings Impoundment soil cover - grading	11.4	ac	$5,000	$57,000	Material already placed
Revegetation for soil cover	11.4	ac	$2,000	$22,800	Impoundment area less creek channel
Treatment of Tailings Impoundment seepage				$802,000	In-situ sorption; 50% removal; FS Table E-22
Armoring of overbank deposits	2,900	cy	$40	$116,000	Vol. estimated from FS Chapter 6 figures
Removal of selected overbank deposits	37,000	cy	$20	$740,000	Vol. estimated from FS Chapter 6 figures
Armoring residual above human health PRG	1,000	cy	$40	$40,000	Allowance
Channel for Blackbird Creek near PCI				$29,000	See FS Table E-23
Establish institutional controls				$50,000	Allowance
Subtotal				$1,972,800	
Contractor overhead and profit			20%	$395,000	
Engineering and construction surveillance			25%	$493,000	
Agency oversight			10%	$197,000	
Project management and legal			10%	$197,000	
Contingency			25%	$493,000	
TOTAL CAPITAL COSTS				**$3,747,800**	
OPERATIONS AND MAINTENANCE COSTS				Present value calculation, 7% net interest	
Tailings Impoundment soil cover maintenance	30	yr	$4,000	$50,000	Allowance
Meadow Creek treatment	30	yr	$20,000	$248,000	Diversion option; see FS Table E-18
Tailings Impoundment seepage treatment	30	yr	$67,000	$831,000	See FS Table E-22
Inspection and monitoring of armoring	30	yr	$10,000	$124,000	Allowance
Maintenance of existing fencing	30	yr	$1,000	$12,000	Allowance
Sediment cleanout of Blackbird channel near PCI	30	yr	$4,000	$50,000	Allowance for infrequent event
Monitoring and reporting (see Table E-29)	30	yr		$650,000	Present value cost of cash flow
Subtotal				$2,165,000	
Project management			5%	$108,000	
Agency oversight			10%	$217,000	
Contingency			25%	$541,000	
NET PRESENT VALUE O&M COST				**$3,031,000**	
TOTAL ALTERNATIVE COST				**$6,778,800**	Net present value [b]

[a] Costs are for early 2002. Costs do not included current O&M costs.

[b] The sum of capital costs and the net present value of long-term O&M costs.

TABLE 12-2
ESTIMATED COST FOR ALTERNATIVE BB-7b

Item	Quantity	Units	Unit Cost	Cost [a]	Notes
CAPITAL COSTS					
Collect Meadow Creek seeps				$116,000	See FS Table E-18
Tailings Impoundment soil cover - grading	11.4	ac	$5,000	$57,000	Material already placed
Revegetation for soil cover	11.4	ac	$2,000	$22,800	Impoundment area less creek channel
Treatment of Tailings Impoundment seepage				$1,570,000	In-situ package treatment plant; See FS Table E-21
Armoring of overbank deposits	2,900	cy	$40	$116,000	Vol. estimated from FS Chapter 6 figures
Removal of selected overbank deposits	37,000	cy	$20	$740,000	Vol. estimated from FS Chapter 6 figures
Armoring residual above human health PRG	1,000	cy	$40	$40,000	Allowance
Channel for Blackbird Creek near PCI				$29,000	See FS Table E-23
Establish institutional controls				$50,000	Allowance
Subtotal				$2,740,800	
Contractor overhead and profit			20%	$548,000	
Engineering and construction surveillance			25%	$685,000	
Agency oversight			10%	$274,000	
Project management and legal			10%	$274,000	
Contingency			25%	$685,000	
TOTAL CAPITAL COSTS				**$5,206,800**	
OPERATIONS AND MAINTENANCE COSTS				Present value calculation, 7% net interest	
Tailings Impoundment soil cover maintenance	30	yr	$4,000	$50,000	Allowance
Meadow Creek treatment	30	yr	$20,000	$248,000	Diversion option; see FS Table E-18
Tailings Impoundment seepage treatment	30	yr	$161,000	$1,998,000	See FS Table E-20
Inspection and monitoring of armoring	30	yr	$10,000	$124,000	Allowance
Maintenance of existing fencing	30	yr	$1,000	$12,000	Allowance
Sediment cleanout of Blackbird channel near PCI	30	yr	$4,000	$50,000	Allowance for infrequent event
Monitoring and reporting (see Table E-29)	30	yr		$850,000	Present value cost of cash flow
Subtotal				$3,332,000	
Project management			5%	$167,000	
Agency oversight			10%	$333,000	
Contingency			25%	$833,000	
NET PRESENT VALUE O&M COST				**$4,665,000**	
TOTAL ALTERNATIVE COST				**$9,871,800**	Net present value [b]

[a] Costs are for early 2002. Costs do not included current O&M costs.

[b] The sum of capital costs and the net present value of long-term O&M costs.

TABLE 12-3
ESTIMATED COSTS FOR ALTERNATIVE BB-7c

Item	Quantity	Units	Unit Cost	Cost [a]	Notes
CAPITAL COSTS					
Collect Meadow Creek seeps				$116,000	See FS Table E-18
Tailings Impoundment soil cover - grading	11.4	ac	$5,000	$57,000	Material already placed
Revegetation for soil cover	11.4	ac	$2,000	$22,800	Impoundment area less creek channel
Treatment of Tailings Impoundment seepage				$1,920,000	Pump to WTP; 80% removal; FS Table E-20
Armoring of overbank deposits	2,900	cy	$40	$116,000	Vol. estimated from FS Chapter 6 figures
Removal of selected overbank deposits	37,000	cy	$20	$740,000	Vol. estimated from FS Chapter 6 figures
Armoring residual above human health PRG	1,000	cy	$40	$40,000	Allowance
Channel for Blackbird Creek near PCI				$29,000	See FS Table E-23
Establish institutional controls				$50,000	Allowance
Subtotal				$3,090,800	
Contractor overhead and profit			20%	$618,000	
Engineering and construction surveillance			25%	$773,000	
Agency oversight			10%	$309,000	
Project management and legal			10%	$309,000	
Contingency			25%	$773,000	
TOTAL CAPITAL COSTS				**$5,872,800**	
OPERATIONS AND MAINTENANCE COSTS				Present value calculation, 7% net interest	
Tailings Impoundment soil cover maintenance	30	yr	$4,000	$50,000	Allowance
Meadow Creek treatment	30	yr	$20,000	$248,000	Diversion option; see FS Table E-18
Tailings Impoundment seepage treatment	30	yr	$144,000	$1,787,000	See FS Table E-20
Inspection and monitoring of armoring	30	yr	$10,000	$124,000	Allowance
Maintenance of existing fencing	30	yr	$1,000	$12,000	Allowance
Sediment cleanout of Blackbird channel near PCI	30	yr	$4,000	$50,000	Allowance for infrequent event
Monitoring and reporting (see Table E-29)	30	yr		$850,000	Present value cost of cash flow
Subtotal				$3,121,000	
Project management			5%	$156,000	
Agency oversight			10%	$312,000	
Contingency			25%	$780,000	
NET PRESENT VALUE O&M COST				**$4,369,000**	
TOTAL ALTERNATIVE COST				**$10,241,800**	Net present value [b]

[a] Costs are for early 2002. Costs do not included current O&M costs.

[b] The sum of capital costs and the net present value of long-term O&M costs.

TABLE 12-4
ESTIMATED COST FOR ALTERNATIVE BT-5

Item	Quantity	Units	Unit Cost	Cost [a]	Notes
CAPITAL COSTS					
Collection and treatment of Bucktail Creek seeps				$190,000	Phase 1; see FS Table E-24
Collection and treatment of Bucktail Creek seeps				$879,000	Phase 2; see FS Table E-25
Divert Bucktail Creek directly to Big Deer Creek	3,400	lf	$45	$153,000	24-inch HDPE pipe
Flow Splitter				$10,000	Estimate
Diffuser				$30,000	Discharge into Big Deer Creek
Subtotal				$1,222,000	
Contractor overhead and profit			20%	$244,000	
Engineering and construction surveillance			25%	$306,000	
Agency oversight			10%	$122,000	
Project management and legal			10%	$122,000	
Contingency			25%	$306,000	
TOTAL CAPITAL COSTS				**$2,322,000**	
OPERATIONS AND MAINTENANCE COSTS				Present value calculation, 7% net interest	
Collection and treatment of Bucktail Creek seeps	30	yr	$39,000	$484,000	Phase 1; see FS Table E-24
Collection and treatment of Bucktail Creek seeps	30	yr	$25,000	$310,000	Phase 2; see FS Table E-25
Sediment dam maintenance or removal				$50,000	Allowance
Monitoring and reporting (see Table E-29)	30	yr		$850,000	Present value cost of cash flow
Subtotal				$1,694,000	
Project management			5%	$85,000	
Agency oversight			10%	$169,000	
Contingency			25%	$424,000	
NET PRESENT VALUE O&M COST				**$2,372,000**	
TOTAL ALTERNATIVE COST				**$4,694,000**	Net present value [b]

[a] Costs are for early 2002. Costs do not included current O&M costs.

[b] The sum of capital costs and the net present value of long-term O&M costs.

TABLE 12-5
ESTIMATED COST FOR COMBINED ALTERNATIVES P-2/P-3

Item		Quantity	Units	Unit Cost	Cost [a]	Notes
CAPITAL COSTS						
Establish instutional controls					$40,000	Allowance
Selective removal - Rufe		800		$50	$40,000	Vol. estimated from FS Chapter 6 figures
Selective removal - Strawn		300		$50	$15,000	Vol. estimated from FS Chapter 6 figures
	Subtotal	1,100			$95,000	
Contractor overhead and profit				20%	$19,000	
Engineering and construction surveillance				25%	$24,000	
Agency oversight				10%	$10,000	
Project management and legal				10%	$10,000	
Contingency				25%	$24,000	
TOTAL CAPITAL COSTS					**$182,000**	
OPERATIONS AND MAINTENANCE COSTS						
Institutional controls monitoring (allowance)		30	yr	$5,000	$62,000	Present value cost of cash flow
Monitoring and reporting (see Table E-29)		30	yr	$10,000	$124,000	Present value cost of cash flow
	Subtotal				$186,000	
Project management				5%	$9,000	
Agency oversight				10%	$19,000	
Contingency				25%	$47,000	
NET PRESENT VALUE O&M COST					**$261,000**	
TOTAL ALTERNATIVE COST					**$443,000**	Net present value [b]

[a] Costs are for early 2002.

[b] The sum of capital costs and the net present value of long-term O&M costs.